WHAT IS CLAIMED:

1. A process for decomposing a cumene oxidation product mixture containing cumene hydroperoxide (CHP) and dimethylphenyl carbinol (DMPC) to produce phenol, acetone and alpha-methyl styrene (AMS) with enhanced safety of operation and reduced by-product formation which comprises the steps:

(a) mixing the cumene oxidation product in a stirred or back-mixed reactor with an acid catalyst, with 10 to 100 percent acetone relative to the amount of acetone produced during the decomposition reaction, and with up to 4 weight percent additional amounts of water relative to the reaction mixture, at an average temperature between about 50°C and about 90°C for a time sufficient to lower the average CHP concentration of the reactor to between about 0.2 and about 3.0 weight percent, and wherein a portion of DMPC is converted to dicumyl peroxide (DCP); then

(b) reacting the reaction mixture from step (a) at a temperature between about 120°C and 150°C under plug-flow conditions for a time sufficient to decompose substantially all residual CHP and at least 90 percent of the DCP formed in step (a).

2. The process of claim 1 wherein step (a) additionally comprises reacting the reaction mixture having an average CHP concentration of between about 0.2 and about 3.0 weight percent at between 50°C and about 90°C under plug-flow conditions for a time sufficient to produce a reaction mixture having a CHP concentration no greater than about 0.4 weight percent.

3. The process of claim 2 further comprising the step:

(c) submitting the reaction product from step (b) to adiabatic flash evaporation to recover an acetone-rich distillate and recycling said distillate to step (a) to provide said acetone.

4. The process of claim 3 wherein the CHP concentration is monitored by on-line analysis.

5. The process of claim 1 further comprising the step:

(c) submitting the reaction product from step (b) to adiabatic flash evaporation to recover an acetone-rich distillate and recycling said distillate to step (a) to provide said acetone.

6. The process of claim 5 wherein the CHP concentration is monitored by on-line analysis.

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